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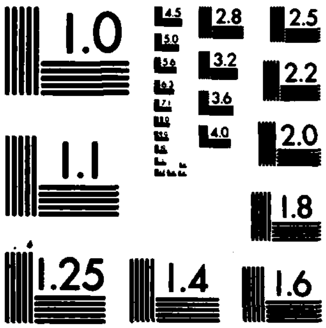


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# FOREIGN TECHNOLOGY DIVISION



## RADOMES FOR FLIGHT VEHICLES

by

B. A. Prigoda and V. S. Kokun'ko





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# EDITED TRANSLATION

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RADOMES FOR FLIGHT VEHICLES

By: B. A. Prigoda and V. S. Kokun'ko

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## U. S. BOARD ON GEOGRAPHIC NAMES TRANSLITERATION SYSTEM

| Block | Italic | Transliteration | Block | Italic | Transliteration |
|---|---|---|---|---|---|
| А а | *А а* | A, a | Р р | *Р р* | R, r |
| Б б | *Б б* | B, b | С с | *С с* | S, s |
| В в | *В в* | V, v | Т т | *Т т* | T, t |
| Г г | *Г г* | G, g | У у | *У у* | U, u |
| Д д | *Д д* | D, d | Ф ф | *Ф ф* | F, f |
| Е е | *Е е* | Ye, ye; E, e* | Х х | *Х х* | Kh, kh |
| Ж ж | *Ж ж* | Zh, zh | Ц ц | *Ц ц* | Ts, ts |
| З з | *З з* | Z, z | Ч ч | *Ч ч* | Ch, ch |
| И и | *И и* | I, i | Ш ш | *Ш ш* | Sh, sh |
| Й й | *Й й* | Y, y | Щ щ | *Щ щ* | Shch, shch |
| К к | *К к* | K, k | Ъ ъ | *Ъ ъ* | " |
| Л л | *Л л* | L, l | Ы ы | *Ы ы* | Y, y |
| М м | *М м* | M, m | Ь ь | *Ь ь* | ' |
| Н н | *Н н* | N, n | Э э | *Э э* | E, e |
| О о | *О о* | O, o | Ю ю | *Ю ю* | Yu, yu |
| П п | *П п* | P, p | Я я | *Я я* | Ya, ya |

*ye initially, after vowels, and after ъ, ь; e elsewhere.
When written as ё in Russian, transliterate as yё or ё.

## RUSSIAN AND ENGLISH TRIGONOMETRIC FUNCTIONS

| Russian | English | Russian | English | Russian | English |
|---|---|---|---|---|---|
| sin | sin | sh | sinh | arc sh | $sinh^{-1}$ |
| cos | cos | ch | cosh | arc ch | $cosh^{-1}$ |
| tg | tan | th | tanh | arc th | $tanh^{-1}$ |
| ctg | cot | cth | coth | arc cth | $coth^{-1}$ |
| sec | sec | sch | sech | arc sch | $sech^{-1}$ |
| cosec | csc | csch | csch | arc csch | $csch^{-1}$ |

| Russian | English |
|---|---|
| rot | curl |
| lg | log |

**GRAPHICS DISCLAIMER**

**All figures, graphics, tables, equations, etc. merged into this translation were extracted from the best quality copy available.**

RADOMES FOR FLIGHT VEHICLES
(pages 70-73)

B. A. Prigoda and V. S. Kokun'ko

## 2.9. Radomes with Metal Inclusions

In a number of cases the half-wave three-seven layer construction of the wall for some reason or other does not satisfy the designer of the radome. Such reasons include insufficient wide-band feature, or heavy weight, or poor airtightness, etc.

We will take the case of a thin-walled construction. In principle it is possible to select the wall thickness such that it will satisfy in respect to radio transmittance all the requirements in the assigned band of frequencies and in the assigned scanning angle sector of the antenna. However, there is still another requirement which in this case remains unfulfilled. This is the insufficient strength of such a construction. As was already mentioned above, a partial escape from this position can be the strengthening of the construction due to the use of a rigid metal frame, which would take upon itself the main load. However, the use of such frames is not always practically advisable. First of all, by virtue of an increase in weight, difficulties in realization of the junction between the metal and the dielectric, and also by virtue of the fact that the metal frame has an active influence on the passage of waves and distorts the direction-finding characteristics of the "antenna - radome" system. Half-wave and three-layer constructions, which guarantee strength, in some cases are not admissable from the point of view of heavy weight.

An approach to the calculation of walls of radomes from the point of view of the known positions of the theory of long lines, when the wall is considered as a multipole, containing L, C, R-links, makes it possible to find a path for lowering the weight of the walls while preserving their radio-engineering characteristics. Thus in the case of a single-layer radome, if it is considered that the reflection of the energy of the incident wave originates from a capacitance heterogeneity, developing due to the difference from unity of the relative dielectric transmittance of the material of the radome, then this reflection in principle can be lessened, having compensated for this heterogeneity with the help of inductance, introduced artificially into the structure of the radome wall.

A network of thin metal rods can serve as such an inductance. The inductance of the network is determined by the thickness of the rods and their spacing. Figure 2.13 shows the layout of a wall of a radome with metal inclusions in the form of inductive rods. Also shown there are the calculated (solid lines) and experimental (broken lines) curves of the reflection coefficient R from such a wall. The curves pertain to the case of normal incidence of the wave on the wall. It is evident that such curves can also be obtained by the calculation method for the more complex case of incidence of the wave on a curvilinear wall, when the angles of incidence can change in specific limits and in a general case can differ considerably from a null value.

Separate attention will be given to this below.

Using the positions of the theory of long lines, it is possible to make a calculation for walls which contain metal inclusions and which have a more complex configuration than the inductive metal gratings cited above. We are talking about massive frames, fulfilling the role of power elements. It turns out that, with the rational selection of the form of the ribs of the frame, their dimensions and mutual position, it is possible, quite effectively, to compensate for their influence, having raised sharply the radio transmittancy of the construction. Investigations of such structures, carried out with the use of the theory of diffraction, make it possible to note paths for realizing the partial and total replacement of a dielectric radome with a metal frame or without it by an all-metal radome. Radio transmittance of such a radome is provided by a system of openings which are selected in a specific manner.

Figure 2.14 gives examples of radomes with walls strengthened by a metal frame (a, b), and a radome with an all-metal wall (c).

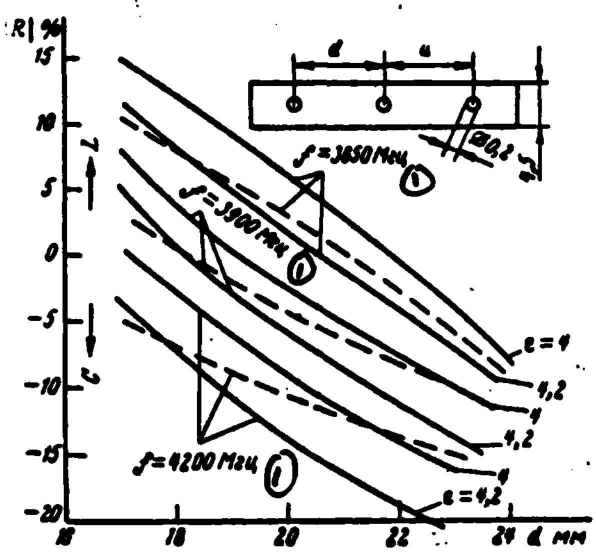

Figure 2.13. Layout of a wall with metal inductive rods.
Key: (1) Mhz.

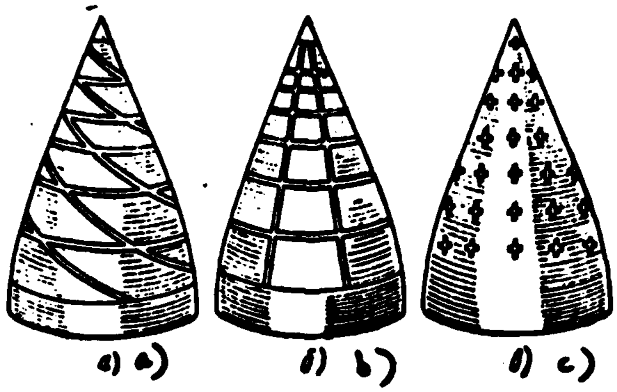

Figure 2.14. Strengthening of a wall with a metal frame.

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